

# Mathematics Toolkit: Grade 7 Objective 2.E.1.a

Standard 2.0 Knowledge of Geometry

Topic E. Transformations

Indicator 1. Analyze a transformation on a coordinate plane

Objective a. Identify, describe, and plot the results of one transformation on a coordinate plane

Assessment Limits:

Identify or plot the result of one translation (horizontal or vertical), reflection (horizontal or vertical), or rotation about a given point ( $90^\circ$  or  $180^\circ$ )

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## Clarification

### Mathematics Grade 7 Objective 2.E.1.a Assessment Limit 1

A transformation of a geometric figure is a change in its position, size or shape. When the position of a figure is changed, the original geometric figure (or preimage) is moved on a plane to create an image with the exact same size and shape as the original figure.

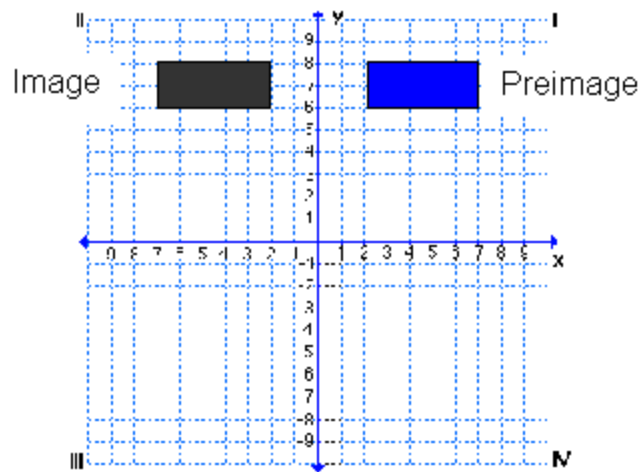
A reflection is a transformation in which the original geometric figure (preimage) is flipped over a line, called the line of reflection, to create an image. All corresponding points in the image and the original figure are equidistant (or the same distance) from the line of reflection.

A rotation is a transformation in which the original geometric figure (preimage) is turned about a point in a clockwise or counterclockwise direction to create an image.

A translation is a transformation in which every point of the original figure (preimage) is moved the same distance — up, down, left, or right (a slide).

### Classroom Example 1

Given a geometric figure and a transformation of that geometric figure, identify whether the transformation is a reflection (flip), rotation (turn) or translation (slide).

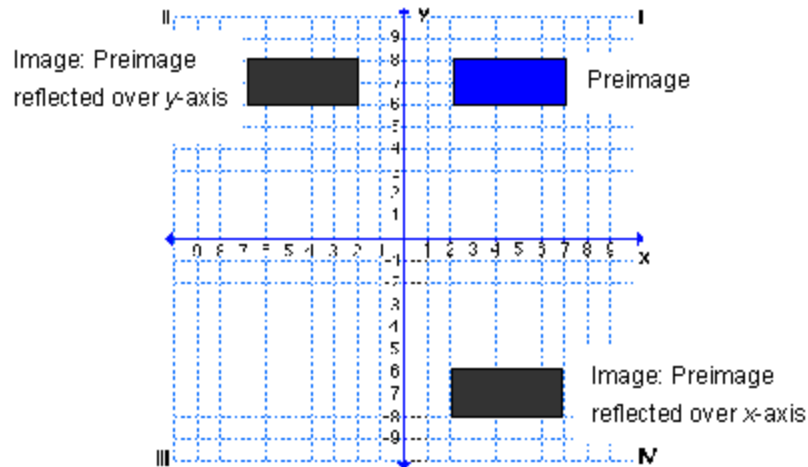


Sample correct answer: The transformation is a reflection over the y-axis or a translation of 9 units left.

### Classroom Example 2

Reflect a shape over the x-axis (flip the shape up or down) and identify the coordinates of the vertices of the new shape. When this happens, the x-coordinates remain the same, but the new y-coordinates are opposites of the original.

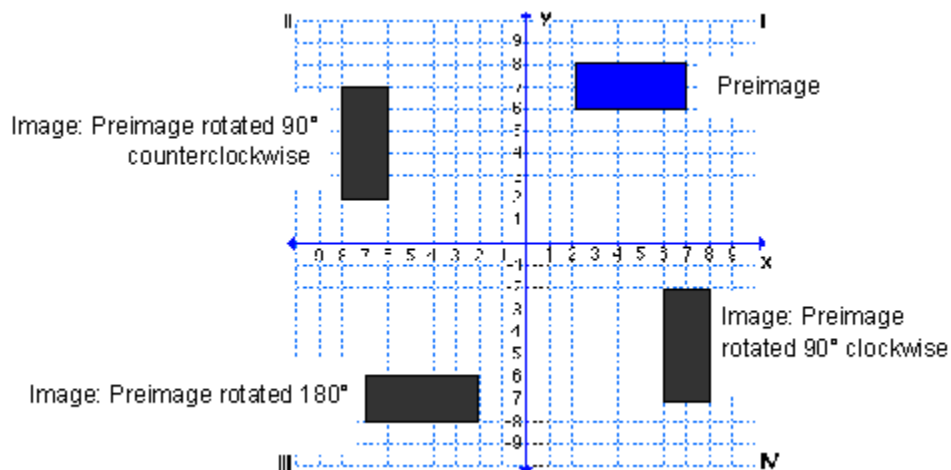
Reflect a shape over the y-axis (flip the shape left or right) and identify the coordinates of the vertices of the new shape. For this, the y-coordinates remain the same, but the x-coordinates are opposites of the original.



### Classroom Example 3

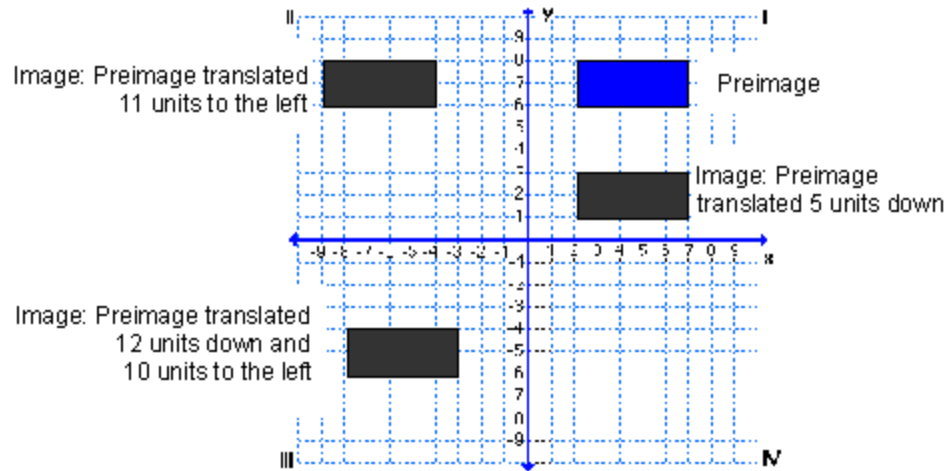
Rotate a shape  $90^\circ$  (around the origin) clockwise or counterclockwise. The new coordinates are determined by first switching the x- and y-coordinates, then taking the opposite of the x- or y-coordinate, depending on the direction of rotation. If the shape is rotated clockwise, take the opposite of the new y-coordinate. If the shape is rotated counterclockwise, take the opposite of the new x-coordinate.

To rotate a shape  $180^\circ$ , switch the x- and y-coordinates and take the opposite of both values.



### Classroom Example 4

Translate a figure (in one direction - up/down/left or right) and draw the new figure. Identify the coordinate points of the vertices of the new shape. 'Track' one vertex in the figure and create or determine the shift that the figure has taken. Check with a second vertex that the shift is the same or complete the shift with the remaining vertices.



## Lesson Seeds

### Mathematics Grade 7 Objective 2.E.1.a Assessment Limit 1

#### Materials needed

Clear large transparent coordinate grid, class set of colored transparency polygons (square, rectangle, triangle, pentagon). Create polygons that have integral coordinates as vertices so that original and transformed vertices' coordinates are easier to read on the grids. Student sheets for recording.

#### Activities

Provide the class with a selection of transformations (such as 10 translations, 10 reflections, and 10 rotations, again, one for each student) and the set of colored transparency polygons.

- Each student selected will choose a polygon and a transformation.
- The student places the polygon on the coordinate grid transparency and gives the other students time to record the coordinate points for the vertices of the polygon in its starting position (original position). (Note: a numbered coordinate grid will be useful in the beginning).
- The student at the overhead performs the transformation and the other students record the new position (image) of the polygon, as well as the transformation performed. The teacher asks the students in the class if they agree with the result with the result of the transformation, and requires them to justify their responses.

Student sheets should have five columns: Presenter, Polygon, Starting Position, Transformation, and Ending Position. See the example below. Answers can be reviewed aloud as students can keep the card indicating their transformation until the end of class. Ask students what patterns they see in all of the translations, all of the rotations, and all of the reflections.

Example:

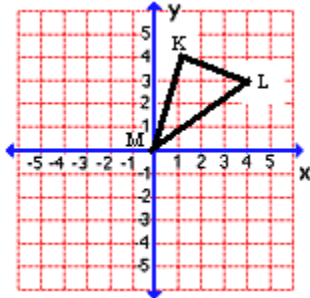
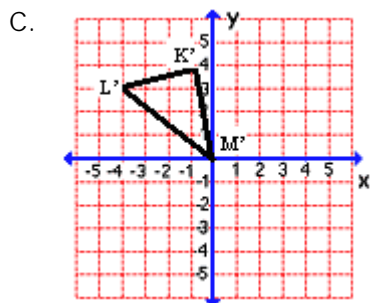
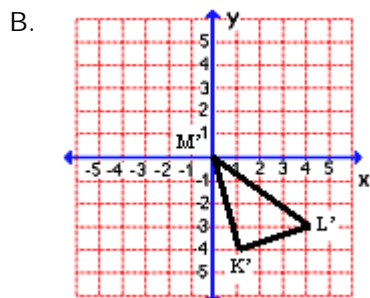
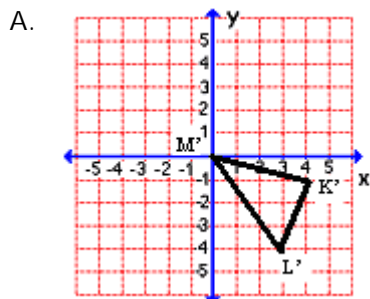
Presenter	Polygon	Starting Position	Transformation	Ending Position
Joe	Triangle	Point A (3, 4) Point B (6, 1) Point C (-1, 1)	Translation left 4	Point A' (-1, 4) Point B' (2, 1) Point C' (-5, 1)
Maria	Parallelogram	Point Q (2, 3) Point R (4, 6) Point S (-1, 5) Point T (-3, 2)	Reflect over the x-axis	Point Q' (2, -3) Point R' (4, -6) Point S' (-1, -5) Point T' (-3, -2)

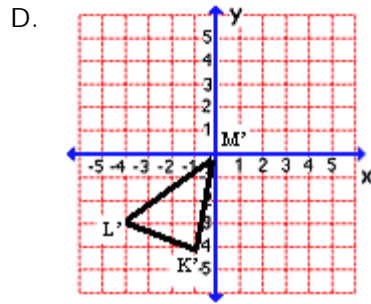
Sample correct responses:

- When translating to the right, the x-coordinate increases by the number of units of the translation
- When translating to the left, the x-coordinate decreases by the number of units of the translation
- When translating up, the y-coordinate increases by the number of units of the translation
- When translating down, the y-coordinate decreases by the number of units of the translation
- When reflecting across the x-axis, the y-coordinates of the ending position are the opposites of the y-coordinates of the starting position
- When reflecting across the y-axis, the x-coordinates of the ending position are the opposites of the x-coordinates of the starting position
- When rotating  $90^\circ$  clockwise, the x- and y-coordinates of the starting position and the ending position interchange and the ending position y-coordinates become opposite of the starting position x-coordinates
- When rotating  $90^\circ$  counterclockwise, the x- and y-coordinates of the starting position and the ending position interchange and the ending position x-coordinates become opposite of the starting position y-coordinates
- When rotating  $180^\circ$ , the x- and y-coordinates of the starting position are opposite of the ending position x- and y-coordinates

## Sample Item #1 - Selected Response (SR) Item

Mathematics Grade 7 Objective 2.E.1.a

Look at  $\triangle KLM$  plotted on the coordinate plane below.Which coordinate plane shows a reflection of  $\triangle KLM$  over the x-axis?



Correct Answer:

B